

## ABSTRACT OF THE DISCLOSURE

Systems and methods are described for an optical microscope using an interferometric source of multi-color, multi-beam entangled photons. A method includes: downconverting a beam of coherent energy to provide a beam of multi-color entangled photons; converging two 5 spatially resolved portions of the beam of multi-color entangled photons into a converged multi-color entangled photon beam; transforming at least a portion of the converged multi-color entangled photon beam by interaction with a sample to generate an entangle photon specimen beam; and combining the entangled photon specimen beam with an entangled photon reference beam within a single beamsplitter.. An apparatus includes: a multi-refringent 10 device providing a beam of multi-color entangled photons; a condenser device optically coupled to the multi-refringent device, the condenser device converging two spatially resolved portions of the beam of multi-color entangled photons into a converged multi-color entangled photon beam; a beam probe director and specimen assembly optically coupled to the condenser device; and a beam splitter optically coupled to the beam probe director and 15 specimen assembly, the beam splitter combining an entangled photon specimen beam from the beam probe director and specimen assembly with an entangled photon reference beam.

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